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EDITORIAL

Sex and age disparities in physical activity among Brazilian adolescents: nature or nurture?☆,☆☆

Desigualdades de sexo e idade na atividade física entre adolescentes brasileiros: natureza ou educação?

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Many have deemed physical activity as a best buy for public health.[1] Regular practice of physical activity provides a myriad of health benefits for people of all ages, including reduced risk of cardiovascular disease, diabetes, several cancers, falls, dementia, and obesity.[2,3] Recently published data show that 39% of adults and 85% of adolescents in Latin America are physically inactive.[4,5] In Brazil, 47% of adults and 81% of adolescents (78% for boys and 84% for girls) do not meet the minimum recommended levels of physical activity.[3,4]

There is a well-documented decline in physical activity levels when transitioning from childhood to adolescence and from adolescence to adulthood.[6,7] Adolescence represents a time in life where personality traits, values and beliefs, and health-related habits start to become defined. As such, it is a critical period to reinforce the adoption of active lifestyles, which can be carried on through adulthood.

Among the key known determinants of physical activity participation levels (at all life stages) are two biological factors: sex and age. In the article ''Is the association between sociodemographic variables and physical activity levels in adolescents mediated by social support and self-efficacy?'', published in this issue,[8] Cheng et al. take an interesting and much needed next step towards advancing our knowledge regarding the potential causal pathways through which sex and age influence physical activity levels among youth. Females are less active than males.[9] This is a well-known fact, and is true across settings (including Latin American countries[5]), socioeconomic strata, and age-groups. But why is this the case? Some have hypothesized potential biological mechanisms to explain these differences. For instance, women have less muscle mass and anaerobic power than men, and tend to mature earlier.[10,11] It has also been suggested that men may be evolutionary ''wired'' to enjoy sports more than women, and to engage in more movement overall (our male human ancestors were hunters, providers, and protectors, while females were gatherers and home

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keepers; two roles with substantial differences in energy expenditure).[12] However, others have pointed out the influence that psychological and social factors around gender may have on this relation.[13] Similarly, those older in age are less active than their younger counterparts.[6,9,14] This is not only true when contrasting older adults to younger age-groups. A 16-year-old adolescent is likely to be less active than a 15-year-old one, despite the fact that our bodies reach their full maturation potential at around age 22 (years). Thus, the question of whether the declines in physical activity are purely driven by biology is quite intriguing. Do we become less active as we age because of expected age-related functional decline, or do psychosocial factors come into play to reinforce less movement as we age?

Cheng et al. addressed the potential roles of two important psychosocial constructs (self-efficacy and social support) on the known effects of sex and age on physical activity.[9] They did so through a well-conducted study, which had among its strengths a robust representative sample of over 2500 Northern Brazilian adolescents, the use of culturally appropriate and validated measures, and a sophisticated analysis to test the hypothesized mediator (intermediary variable) role of the two psychosocial variables of interest. This is among the first studies in Brazil and the entire Latin American region that goes beyond identifying correlates of physical activity, by attempting to better define specific pathways of action. It is, in essence, a mechanistic study. Another critical strength of their study is that it is grounded in strong behavioural theory – something often lacking in correlate and determinant studies in Latin America, since the field of behavioural science within public health remains nascent in the region.[15]

The two studied psychosocial constructs by Cheng et al. are not trivial. While self-efficacy and social support can collectively be grouped under the umbrella term of ''psychosocial variables'', they represent two very distinctly hypothesized causal pathways. Self-efficacy addresses the role of the individual as a self-driver of behaviour. In fact, some evidence supports that self-efficacy is mainly determined by genetics.[16] In turn, social support addresses the role of the social environment in influencing the behaviour of the individual. Hence, these two psychosocial variables represent opposite ends of the individual-environment spectrum. Cheng et al. explored the roles of nature (self-efficacy) and of nurture (social support) as potential mediators of the effect of two known biological determinants (sex and age) on physical activity. They did so in a population (Brazilian adolescents) where this research question had not been previously addressed.

Not surprisingly, an interesting research question yielded equally interesting results. Cheng et al. report evidence for a potential mediating role of social support, but not for self-efficacy, in the effect of sex and age on physical activity among Northern Brazilian adolescents. Pending verification by longitudinal studies, their findings suggest that one of the reasons why adolescent Brazilian boys are more active than girls is because of their social environment: both friends and family are more supportive of boys' participation in physical activity than of girls'. Hence, these results suggest that one of the underlying causes of sex disparities in physical activity levels is that society is not as supportive of active lifestyles among adolescent girls as it is for boys. This inherently suggests that the social norms around gender roles and physical activity operating in Brazilian society are at the root cause for the observed differential levels of physical activity by sex. Interestingly, Cheng et al. did not find evidence for a mediating role of self-efficacy (a frequently reported correlate for physical activity in other studies[17]) on the relation of sex and physical activity among Northern Brazilian adolescents. Combined, these two findings suggest that the solution to the sex-based disparities in physical activity levels among Brazilian adolescents may lie in changing social norms and social environments, rather than in targeting the individual. Interventions aiming to transform the social environment of Brazil to become as supportive and accepting of active girls as it is of active boys should be tested.

Perhaps even more remarkable is the reported result showing a potential mediating role of parental social support on the effect of age on physical activity. While it is well accepted that physical activity declines with age, many have mainly attributed this to biological factors.[14] However, this study presents evidence that societal influences play a strong role on this decline among adolescents. It is important to highlight that the age range studied was not very wide, as this study was restricted to adolescents (ages 14–19 years). Hence, the age decline is not due to the contrast of adults *versus* adolescents, or of adolescents *versus* children. Rather, it is the result of comparing older adolescents to younger adolescents. Two features are interesting of this finding. First, that as with sex, evidence of a mediating role on the relation between age and physical activity was only found for social support, not for self-efficacy. Hence, the significant role of the social environment (nurture), as opposed to individual drive (nature), is once again stressed. Second, the fact that in this case, only parental social support, and not peer (friends) social support, was found to act as a mediator of the effect of age on physical activity. It appears that at some point, as adolescents age, parental support for physical activity declines. This may have to do with the roles and attitudes that one is expected to take on as one transitions into adulthood, which may involve a more sedentary lifestyle. However, it may also have to do with less involvement of parents in their adolescent offspring's activities, as they become more independent and are expected to assume increasing responsibility for their own conduct. Regardless of the underlying factor, this research suggests that one way to prevent the well-known age-related declines in physical activity among Brazilian adolescents is to maintain or even increase parental support for physical activity in the later stages of adolescence.

As the authors discuss, their findings contrast with those of their peers in high-income settings. The fact that Cheng et al. found no mediation effect of self-efficacy (an individual drive factor) on the relation between sex and age on physical activity among Northern Brazilian adolescents is worth reflecting upon. In our view, this supports the idea that, when exploring the potential pathways of action of these seemingly ''standard'' determinants of inactivity (sex and age), local context matters. Brazilian and Latin American societies are well known for their strong collectivistic identities, with a very strong sense of community, and thus, with stronger influence of collective *versus* individual-level factors on all realms of society and behaviour.[18] In turn, the settings where most mechanistic physical activity research

has taken place, such as the United States, Canada, and Northern Europe, have stronger individualistic identities.[18] Following this logic, it makes sense that in cultures where individual merit is most valued (*e.g.*, the United States), a psychosocial variable that measures individual drive (self-efficacy) may act as an intermediary in the pathway linking biological factors with physical activity. Likewise, it follows that social support may act as an intermediary variable for this relation in settings where collective values play a stronger role (*e.g.*, Brazil).

In addition to the roles of collectivistic *versus* individualistic cultural identities, the broad role of context as a driver of the observed results is worth further exploration. For instance, the lack of social support for girls to be active in Brazil may have to do with historical beliefs and traditions around gender roles, or with actual and/or perceived risk of crime and violence among girls as compared to boys. Another aspect that requires deeper study through disaggregation analyses in future research, is whether the mediating role of social support on the effect of sex and age on physical activity among Brazilian adolescents is true for both leisure-time and transport-based activity. Similarly, are social support levels among peers and family different across different socioeconomic strata? What about across different types of built environments? Moreover, are we certain that the *magnitude of the effect* of social support on physical activity is uniform across sexes and age groups in Brazil? That is, does sex or age *moderate* the effect of social support on physical activity, as has been reported for high-income settings?[17] The answers to these questions are not just interesting, but will result critical for designing, testing and scaling up interventions to effectively reduce the gender and age disparities in physical activity levels among Brazilian adolescents.

As the authors well emphasize, this study should not be interpreted as conclusive. Although a sophisticated analysis was conducted to test a hypothesized causal pathway, involving the identification of potential mediators, the cross-sectional nature of this research precludes inferring causality. Robust longitudinal studies are needed to determine with certainty the causal pathways of action of these known biological determinants of physical activity levels among Northern Brazilian adolescents. Nonetheless, this is clearly a very firm and important step in the right direction for this field of research in Brazil and Latin America as a whole, as Cheng et al. ventured into elucidating potential causal mechanisms of action, by grounding their hypotheses and analytic methods in strong behavioural theory. Their study reaffirms that the mechanisms of action of well-known biological determinants (age and sex) of physical activity are not entirely biological themselves. Rather, how society views and interacts with such biological factors (sex, age) appears to be a critical way in which they influence our health.

Brazilian researchers continue to be pioneers in advancing the field of physical activity and public health in Latin America.[19] Future work in other countries of the region should incorporate similar research questions and methods, addressing the causal pathways of the known determinants of inactivity in these settings. The past ten years have seen an exponential growth of physical activity correlate studies from Latin American sites and researchers. Moving forward, longitudinal study designs, including experimental and quasi-experimental studies that establish causal mechanisms of action and include strong behavioural theory frameworks are warranted. As demonstrated by this and other studies, the Latin American region is characterized by a set of unique social, cultural, and physical environments that jointly influence health.[18,20] This warrants innovative context- and setting-specific approaches for physical activity promotion – such as those that have begun to emerge in the region, with Brazil being an innovator through place-based strategies (*e.g.*, Academia da Saúde). Researchers throughout Latin America – the most inactive region of the world – must work together through collaborative networks and follow Brazil's lead. We must step up to the challenge of producing high-quality research that is both methodologically rigorous and contextually relevant to generate impactful evidence for tackling the epidemic of inactivity in our region.

Conflicts of interest

The authors declare no conflicts of interest.

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